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Theory and Applications

Editorial

This special issue contains selected papers from the 12th ACM Symposium on Computational Geometry, which was held May 24–26 1996, in Philadelphia, Pennsylvania, USA, as a part of the second Federated Computer Research Conference (FCRC). Each paper selected for this issue is an example of a growing trend in computational geometry research, in that each one is directed at addressing issues in geometric computing that are motivated from applications in other fields.

In his paper "Linear complexity hexahedral mesh generation", Eppstein shows that any polyhedron forming a topological ball with an even number of quadrilateral sides can be partitioned into a linear number of cells that are topologically cubes. This problem is motivated by mesh generation applications for finite element analysis.

In the paper "Combinatorial and experimental results for randomized point matching algorithms", Irani and Raghavan study randomized algorithms for approximately matching a set of pattern points to a set of background points using a rigid transformation. Such problems are motivated by pose estimation applications in computer vision.

Kahan and Snoeyink, in their paper "On the bit complexity of minimum link paths: Superquadratic algorithms for problems solvable in linear time", study the practical issue of how one implements a geometric algorithm that has a fast growing bit complexity for representing the geometric primitives the algorithm manipulates. They revisit the well-known minimum link-path problem, which itself is motivated by applications in robot motion planning, to show that, although existing "linear time" algorithms use a superquadratic number of bits, efficient approximation algorithms can be produced that use an almost linear number of bits.

In the paper "Partial surface matching by using directed footprints", Barequet and Sharir study the problem of matching a sampled set of points against a surface. This problem is motivated by applications in computer-aided design and manufacturing.

Mücke, Saias and Zhu, in their paper "Fast randomized point location without preprocessing in two- and three-dimensional Delaunay triangulations", study the problem of performing fast point location in Delaunay triangulations. Such problems arise in applications in Geographic Information Systems (GIS), and the solution that Mücke et al. propose is based on a simple "walking" idea popular in the practice of GIS searching. They show by a careful analysis that such a simple searching strategy is quite efficient in the average case.

Mehlhorn et al., in the paper "Checking geometric programs or verification of geometric structures", study a number of classic computational geometry problems, which have a host of well-known applications. The novel contribution of this paper is to investigate how efficient geometric algorithms can easily be augmented so that in addition to producing their output structures, such as a convex hull, they also produce easily-checkable proofs that their computation on this instance is correct. Such an approach

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to program verification has the benefit that it is immediate and correct while not trying to achieve the ambitious goal of proving a program is correct for *all* possible inputs.

In the paper "Temporally coherent conservative visibility", Coorg and Teller study the problem of identifying which polygons are visible in a geometric scene from a changing viewpoint. Such problems are motivated by applications in computer graphics, and the solution proposed by Coorg and Teller has a number of interesting advantages over previous approaches.

The paper "Visualizing geometric algorithms over the Web", by Baker, Cruz, Liotta and Tamassia, is strictly-speaking not an algorithmic paper, in that it presents no new geometric algorithms. Instead, it describes a novel system of animating and visualizing geometric algorithms over the Internet in a way that requires little system overhead and is efficient in terms of its communication efficiency. Such a system is motivated by problems in computer science education.

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